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Epitome

(57) [Abstract]
[Objects of the Invention] It is made to lose by making the regurgitation refrigerant gas of a compressor bypass and controlling the load effect at the time of a partial load in the heat pump which has a sensible-heat

reclaimer.
[Elements of the Invention] It is co[redacted] by the sensible-heat reclaimer 2 and[redacted] condenser 2, and liquefies, and a receiver 4 is covered with the refrigerant gas of a compressor 1. This liquid evaporates with a condenser 2 through the expansion valve 5, and returns to a compressor 1. From the sensible-heat reclaimer 2 and a condenser 3, warm water adjusts a load effect from an evaporator 6 by making a refrigerant gas bypass by carrying out gang control of the bypass valves 8 and 12 for the bypass piping 7 and 11 with a control panel 9, although cold water is obtained, and temperature fluctuation of warm water and cold water decreases.

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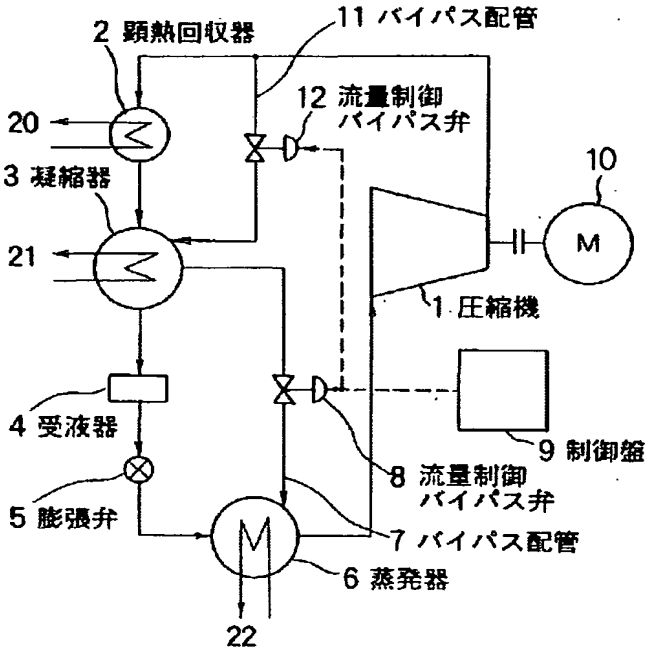

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CLAIMS

[Claim(s)]
[Claim 1] The heat pump characterized by to have prepared the 2nd bypass circuit which bypasses said sensible-heat reclaimer and leads a part of regurgitation refrigerant gas from said compressor to said condenser in the heat pump which comes to prepare the bypass circuit which makes an evaporator control and bypass a part of refrigerant gas through a flow control valve from said condenser, and to prepare the 2nd flow control valve controlled by this 2nd bypass circuit by said flow control valve being interlocked with while having prepared a sensible-heat reclaimer between a compressor and a condenser.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention is set to the heat pump which has air conditioning and a sensible-heat reclaimer in a heating apparatus, and relates to the heat pump which controlled the fluctuation at the time of a partial load.
[0002]
[Description of the Prior Art] The control schematic diagram of the heat pump by which drawing 2 has a sensible-heat reclaimer, and drawing 3 are the heat cycle Fig. In drawing 1 , a compressor 1 is driven with a drive motor 10, it is cooled by the sensible-heat reclaimer 2, the temperature falls, it is further cooled with a condenser 3, it liquefies the compressed refrigerant gas, and a receiver 4 is covered with it. It expands with the expansion valve 5 and a pressure falls, and the refrigerant liquid with which the receiver 4 was covered evaporates with an evaporator 6 further, serves as a refrigerant gas, is again sucked in by the compressor 1, and forms a refrigerating cycle. Cold water 22 is picked out from an evaporator 6 by the sensible-heat reclaimer 2 and the condenser 3, and heating and air conditioning are presented with warm water 20 and 21 from them, respectively.
[0003] The refrigerant gas compressed with the compressor to be shown in drawing 3 is in an overheating region. For this reason, by large-sized heat pump, the sensible-heat reclaimer which became independent apart from the condenser is installed, a refrigerant gas is cooled, and that temperature is brought close to saturation temperature. this -- the ratio of the amount of heating and the amount of refrigeration, and the work thermal equivalent -- COP (called a coefficient of performance or coefficient of performance) is enlarged, it is for improving the effectiveness of heat pump, and about 80% of the sensible heat is usually collected.
[0004] Next, by heat pump, the refrigerant quantity of gas flow and compression ratio which are required of a compressor change sharply to change of an OAT as opposed to air conditioning and heating. That is, the amount of the refrigerant which passes along a condenser, an evaporator, and a compressor changes with a season and time zones sharply.
[0005] In order to correspond to a partial load, when the multistage centrifugal compressor is being used for a compressor, generally a suction vane is extracted and the amount of circulation refrigerants is adjusted by the airflow adjusting method called a suction-vane-control method. Moreover, as shown in drawing 2 , the bypass piping 7 which is open for free passage from a condenser 3 to an evaporator 6 was formed, the control-of-flow bypass valve 8 was formed in this piping 7, the flow rate was controlled, and the partial load was supported by bypassing a refrigerant gas. Automatic control of this control is usually carried out by temperature setup of a control panel 9.
[0006]
[Problem(s) to be Solved by the Invention] Although the whole quantity of compressor regurgitation gas passes in a sensible-heat reclaimer as usually shown in drawing 2 , only in the by-pass rate by bypass piping, gas decreases in a condenser and an evaporator. For this reason, the warm water temperature generated with a sensible-heat reclaimer and a condenser became unstable, and there was a case where a space heating load was changed. The above-mentioned development is explained below using a formula.
[0007] It sets to drawing 3 and is the enthalpy fall of a sensible-heat reclaimer and a condenser, respectively deltah1 and deltah2 It carries out and the amount of compressor diaphragms is made into y % for a partial load x%, and it is as follows supposing it secures the y % of the amounts of compressor intake by opening a bypass valve.
Gross head; delta H=y-delta h1+ x-delta h2 ..... (1)
This value is larger than x (deltah1+deltah2), and does not balance thermally. Even if it balances, warm water supply temperature will change, and the partial load of heat pump is changed.

[0008]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, this invention balances from the circuit to a sensible-heat reclaimer, leads a part of compressor regurgitation gas to a condenser, is interlocked with the bypass circuit of the refrigerant gas from a condenser to an evaporator, controls the flow rate of a refrigerant gas, and loses a load effect.
[0009] Namely, while this invention prepares a sensible-heat reclaimer between a compressor and a condenser In the heat pump which comes to prepare the bypass circuit which makes an evaporator control and bypass a part of refrigerant gas through a flow control valve from said condenser The heat pump characterized by having prepared the 2nd bypass circuit which bypasses said sensible-heat reclaimer and leads a part of regurgitation refrigerant gas from said compressor to said condenser, and preparing the 2nd flow control valve controlled by this 2nd bypass circuit by said flow control valve being interlocked with is offered.
[0010]
[Function] Since this inventions are the above means, a part of compressor regurgitation gas bypasses a sensible-heat reclaimer from the 2nd bypass circuit, and it is led to a direct condenser, and a part of refrigerant gas from a condenser is bypassed from a condenser to an evaporator. Temperature fluctuation of the warm water which gang control of the flow rate of both the bypass circuit is carried out through the 2nd flow control valve and the flow control valve of the bypass circuit between a condenser and an evaporator, and is generated by the sensible-heat reclaimer in heat balance is absorbed.
[0011]
[Example] Hereafter, this invention is concretely explained based on the example shown in a drawing. Drawing 1 is the control schematic diagram of the heat pump concerning one example of this invention. Among drawing, although it quotes as it is and it is explained since signs 1-10, and 20-22 are the same functions as the conventional thing of drawing 2 , the part used as the description of the heat pump of this invention is a part shown with signs 11 and 12.
[0012] If a whole configuration is explained, a compressor 1 will be driven with a drive motor 10, temperature gets down, it will be cooled by the sensible-heat reclaimer 2 and the condensation absorption 3, and a receiver 4 will be covered [it will liquefy as well as the conventional example of drawing 2 , and] with the compressed refrigerant gas. It expands with the expansion valve 5 and a pressure gets down, and this refrigerant liquid evaporates with an evaporator 6, serves as a refrigerant gas, is again sucked in by the compressor 1, and forms the refrigerating cycle. Warm water 20 and 21 is taken out, respectively, and cold water 22 is picked out from an evaporator 6 by the sensible-heat reclaimer 2 and the condenser 3, and heating and air conditioning are presented from them. Moreover, in order to cope with a partial load, from the balance piping 7 which is open for free passage from a condenser 3 to an evaporator 6, a part of refrigerant gas was bypassed by control of the control-of-flow bypass valve 8 controlled by the control panel 9, and the partial load was supported.
[0013] Although the above is the same configuration as the former, the place used as the description part of the heat pump of this invention is explained. A part of refrigerant gas breathed out from the compressor 1 is led to a condenser 3 through the control-of-flow bypass valve 12 from the bypass piping 11 prepared in the condenser 3 from the gas inflow side of the sensible-heat reclaimer 2. With the control-of-flow bypass valve 8 installed in the conventional bypass piping 7, the control-of-flow bypass valve 12 interlocks, and automatic control is carried out by temperature setup of a control panel 9.
[0014] Next, if the above-mentioned operation is explained further, a part of compressor regurgitation gas will bypass the sensible-heat reclaimer 2 via the bypass piping 11, and it will be led to the direct condenser 3, and a part of refrigerant gas will be bypassed from a condenser 3 via the bypass piping 7 as usual to an evaporator 6. The warm water temperature fluctuation which both by-pass rates are open for free passage through the control-of-flow bypass valves 8 and 12 with a control panel 9, are controlled, and is generated by the sensible-heat reclaimer 2 in heat balance is absorbed.
[0015] The above-mentioned operation is explained below using a formula. If above-mentioned (1)-type load is x % and this is divided by x;
deltaH'= (y-delta h1+ x-delta h2)/x = (y/x), deltah1+deltah2 ..... (2)
When not bypassing on the other hand;
delta H=delta h1+deltah2 ..... (3)
(2) Since y is always larger than x in a formula deltaH'>deltaH ..... (4)
Therefore, the gang control of both bypass valves enables it to raise warm water output temperature. That is, although a reverse use of said imbalance is made and it becomes imbalance to rated temperature, thermal balance is secured to time of partial load necessary temperature.
[0016]

[Effect of the Invention] As explained concretely, as mentioned above, by the heat pump of this invention In the heat pump which a sensible-heat reclaimer is prepared [heat pump] between a compressor and a condenser, and makes an evaporator bypass a part of refrigerant gas through a flow control valve from a condenser The 2nd bypass circuit which bypasses a part of regurgitation refrigerant gas from a compressor from the circuit to a sensible-heat reclaimer, and is led to a condenser is prepared. Since said flow control valve and the 2nd interlocking flow control valve are prepared in this 2nd bypass circuit and the flow of a refrigerant gas was controlled Fluctuation of the warm water output generated conventionally is lost, the load effect at the time of the partial load of this seed heat pump is lost, and improvement in the control characteristic can be aimed at. Moreover, by easy construction, the heat pump of this invention repairs established heat pump equipment easily, can apply it, and can prevent the load effect generated with conventional equipment by easy construction.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the control schematic diagram of the heat pump concerning one example of this invention.
[Drawing 2] It is the control schematic diagram of the conventional heat pump.
[Drawing 3] It is the heat cycle Fig. of heat pump.
[Description of Notations]
1 Compressor
2 Sensible-Heat Reclaimer
3 Condenser
6 Evaporator
7 Bypass Piping
8 Control-of-Flow Bypass Valve
9 Control Panel
11 Bypass Piping
12 Control-of-Flow Bypass Valve

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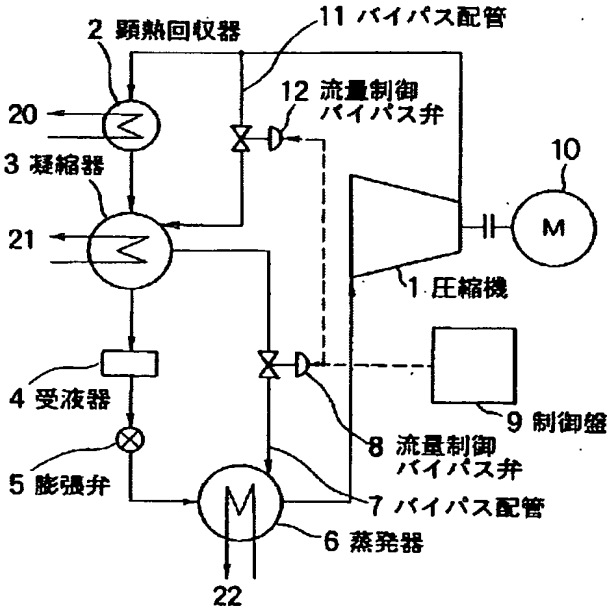
(54)【発明の名称】　ヒートポンプ

(57)【要約】

【目的】　顕熱回収器を有するヒートポンプにおいて部分負荷時の負荷変動を圧縮機の吐出冷媒ガスをバイパスさせて制御することによりなくすようにする。

【構成】　圧縮機１の冷媒ガスは顕熱回収器２，凝縮器２で冷やされ液化し、受液器４にたまる。この液は膨脹弁５を介して凝縮器２で蒸発して圧縮機１に戻る。顕熱回収器２，凝縮器３からは温水が、蒸発器６からは冷水が得られるが、バイパス配管７，１１をバイパス弁８，１２を制御盤９で連動制御することにより冷媒ガスをバイパスさせることにより負荷変動を調整し、温水、冷水の温度変動が減少する。



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【特許請求の範囲】

【請求項１】　圧縮機と凝縮器との間に顕熱回収器を設けると共に、前記凝縮器から蒸発器に冷媒ガスの一部を流量制御弁を介して制御してバイパスさせるバイパス回路を設けてなるヒートポンプにおいて、前記圧縮機からの吐出冷媒ガスの一部を前記顕熱回収器をバイパスして前記凝縮器に導く第２バイパス回路を設け、同第２バイパス回路に前記流量制御弁と連動して制御される第２流量制御弁を設けたことを特徴とするヒートポンプ。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は冷房，暖房装置での顕熱回収器を有するヒートポンプにおいて、部分負荷時における変動を制御するようにしたヒートポンプに関する。

【０００２】

【従来の技術】図２は顕熱回収器を有するヒートポンプの制御系統図、図３はその熱サイクル図である。図１において、圧縮機１は駆動モータ１０で駆動され、圧縮された冷媒ガスは、顕熱回収器２で冷やされてその温度が下がり、更に凝縮器３で冷却されて液化して受液器４にたまる。受液器４にたまった冷媒液は膨脹弁５で膨脹して圧力が下がり、更に蒸発器６で蒸発して冷媒ガスとなり、再び圧縮機１に吸込まれて冷凍サイクルを形成する。顕熱回収器２と凝縮器３からはそれぞれ温水２０，２１が、蒸発器６からは冷水２２が取り出されて、それぞれ暖房及び冷房に供される。

【０００３】図３に示すように圧縮機で圧縮された冷媒ガスは過熱域にある。このため大形のヒートポンプでは凝縮器とは別に独立した顕熱回収器が設置され、冷媒ガスを冷却してその温度が飽和温度に近付けられる。これ＊

総落差；$\Delta H = y \cdot \Delta h_1 + x \cdot \Delta h_2$

この値はｘ（$\Delta h_1 + \Delta h_2$）よりも大きく、熱的にバランスしない。たとえバランスしたとしても温水供給温度が変化し、ヒートポンプの部分負荷が変動する。

【０００８】

【課題を解決するための手段】本発明は前述の課題を解決するために、圧縮機吐出ガスの一部を顕熱回収器への回路からバランスして凝縮器へ導き、凝縮器から蒸発器への冷媒ガスのバイパス回路と連動させて冷媒ガスの流量を制御して負荷変動をなくすようにしたものである。

【０００９】即ち、本発明は、圧縮機と凝縮器との間に顕熱回収器を設けると共に、前記凝縮器から蒸発器に冷媒ガスの一部を流量制御弁を介して制御してバイパスさせるバイパス回路を設けてなるヒートポンプにおいて、前記圧縮機からの吐出冷媒ガスの一部を前記顕熱回収器をバイパスして前記凝縮器に導く第２バイパス回路を設け、同第２バイパス回路に前記流量制御弁と連動して制御される第２流量制御弁を設けたことを特徴とするヒートポンプを提供するものである。

【００１０】

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＊は暖房量及び冷凍量と仕事熱当量の比ＣＯＰ（成績係数又は動作係数と呼ばれる）を大きくして、ヒートポンプの効率を向上するためのもので、通常顕熱の８０％程度が回収される。

【０００４】次にヒートポンプでは冷房と暖房に対し、また外気温度の変化に対して、圧縮機に要求される冷媒ガス流量及び圧縮比が大幅に変化する。即ち、凝縮器，蒸発器及び圧縮機を通る冷媒の量は季節と時間帯によって大幅に変化する。

【０００５】部分負荷に対応するためには、圧縮機に多段遠心圧縮機を使用している場合、一般的には吸込ベーンを絞り、サクションベーンコントロール方式と呼ばれる風量調節法によって、循環冷媒量が調節される。又図２に示すように凝縮器３から蒸発器６に連通するバイパス配管７を設け、この配管７には流量制御バイパス弁８を設けて流量を制御し、冷媒ガスをバイパスすることにより部分負荷に対応していた。この制御は通常制御盤９の温度設定によって自動制御される。

【０００６】

【発明が解決しようとする課題】顕熱回収器では通常図２に示すように圧縮機吐出ガスの全量が通過するが、凝縮器と蒸発器ではバイパス配管によるバイパス量だけガスが減少する。このため顕熱回収器と凝縮器で発生する温水温度が不安定となり、暖房負荷が変動する場合があった。上記現像を数式を使って以下に説明する。

【０００７】図３において、顕熱回収器及び凝縮器のエンタルピー落差をそれぞれΔh_1，Δh_2とし、部分負荷をｘ％、圧縮機絞り量をｙ％として、バイパス弁を開くことによって圧縮機吸込量ｙ％を確保したとすると次のようになる。

…… （１）

【作用】本発明は前述のような手段であるので、圧縮機吐出ガスの一部が顕熱回収器を第２バイパス回路よりバイパスして直接凝縮器へ導かれ、又、凝縮器からの冷媒ガスの一部も凝縮器から蒸発器へバイパスされる。両バイパス回路の流量が第２流量制御弁及び凝縮器と蒸発器間のバイパス回路の流量制御弁を介して連動制御されて熱バランスに当り、顕熱回収器によって発生する温水の温度変動を吸収する。

【００１１】

【実施例】以下、本発明を図面に示す実施例に基いて具体的に説明する。図１は本発明の一実施例に係るヒートポンプの制御系統図である。図中、符号１から１０及び２０から２２は図２の従来のものと同じ機能であるのでそのまま引用して説明するが、本発明のヒートポンプの特徴となる部分は符号１１，１２で示す部分である。

【００１２】図２の従来例と同じく、全体構成を説明すると、圧縮機１は駆動モータ１０で駆動され、圧縮された冷媒ガスは顕熱回収器２，凝縮吸収３で冷却され温度が下り、液化して受液器４にたまる。この冷媒液は膨脹

弁５で膨脹して圧力が下り、蒸発器６で蒸発して冷媒ガスとなり、再び圧縮機１に吸込まれて冷凍サイクルを形成している。顕熱回収器２と凝縮器３からはそれぞれ温水２０，２１が取り出され、又、蒸発器６からは冷水２２が取り出されて暖房及び冷房に供される。又、部分負荷に対処するため、凝縮器３から蒸発器６に連通するバランス配管７からは、制御盤９で制御される流量制御バイパス弁８の制御により、冷媒ガスの一部がバイパスされ部分負荷に対応していた。

【００１３】以上は従来と同じ構成であるが、本発明のヒートポンプの特徴部分となるところを説明する。圧縮機１から吐出された冷媒ガスの一部は、顕熱回収器２のガス流入側から凝縮器３へ設けられたバイパス配管１１から流量制御バイパス弁１２を経て、凝縮器３へ導かれ＊

$$\Delta H' = (y \cdot \Delta h_1 + x \cdot \Delta h_2) / x$$
$$= (y/x) \cdot \Delta h_1 + \Delta h_2 \quad \cdots\cdots\cdots\cdots\cdots\cdots \quad (2)$$

一方、バイパスしないとき；

$$\Delta H = \Delta h_1 + \Delta h_2 \quad \cdots\cdots\cdots\cdots\cdots\cdots \quad (3)$$

（２）式においてｙは常にｘよりも大きいため、

$$\Delta H' > \Delta H \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (4)$$

従って両バイパス弁の連動制御により、温水出力温度を上げることが可能となる。即ち、前記アンバランスが逆用され、定格温度に対してはアンバランスになるが、部分負荷時所要の温度に対しては熱的バランスが確保される。

【００１６】

【発明の効果】以上、具体的に説明したように、本発明のヒートポンプでは、圧縮機と凝縮器との間に顕熱回収器を設けて凝縮器から蒸発器に冷媒ガスの一部を流量制御弁を介してバイパスさせるヒートポンプにおいて、圧縮機からの吐出冷媒ガスの一部を顕熱回収器への回路からバイパスして凝縮器に導く第２バイパス回路を設けて、同第２バイパス回路に前記流量制御弁と連動する第２流量制御弁を設けて冷媒ガスの流れを制御するようにしたので、従来発生していた温水出力の変動がなくなり、この種ヒートポンプの部分負荷時の負荷変動がなくなって、制御特性の向上を図ることができるものである。又、本発明のヒートポンプは既設のヒートポンプ装置を簡単な工事で容易に改修して適用できるもので、従来の装置で発生していた負荷変動を簡単な施工で防止することができるものである。

＊る。流量制御バイパス弁１２は従来のバイパス配管７に設置された流量制御バイパス弁８と共に、制御盤９の温度設定により、連動して自動制御される。

【００１４】次に、上記の作用を更に説明すると、圧縮機吐出ガスの一部がバイパス配管１１を経由して顕熱回収器２をバイパスして直接凝縮器３へ導かれ、また従来同様冷媒ガスの一部がバイパス配管７を経由して凝縮器３から蒸発器６へバイパスされる。両バイパス量が制御盤９により流量制御バイパス弁８，１２を介して連通して制御されて熱バランスに当り、顕熱回収器２によって発生する温水温度変動を吸収する。

【００１５】上記作用を数式を用いて次に説明する。前述の（１）式での負荷はｘ％であり、これをｘで割ると；

【図面の簡単な説明】

【図１】本発明の一実施例に係るヒートポンプの制御系統図である。

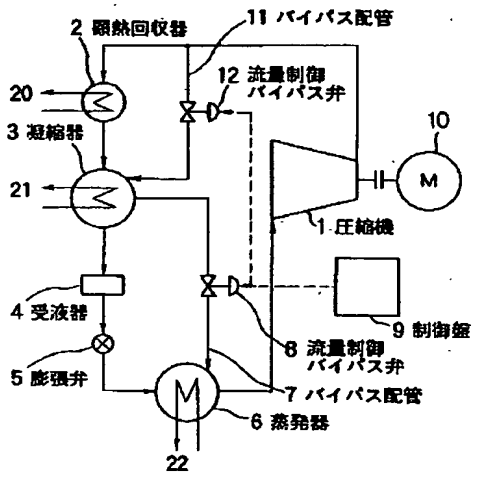
【図２】従来のヒートポンプの制御系統図である。

【図３】ヒートポンプの熱サイクル図である。

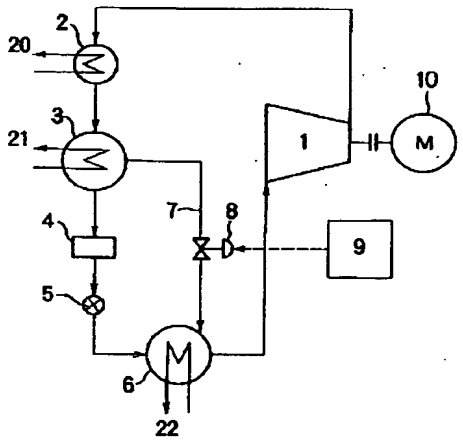
【符号の説明】

１	圧縮機
２	顕熱回収器
３	凝縮器
６	蒸発器
７	バイパス配管
８	流量制御バイパス弁
９	制御盤
１１	バイパス配管
１２	流量制御バイパス弁

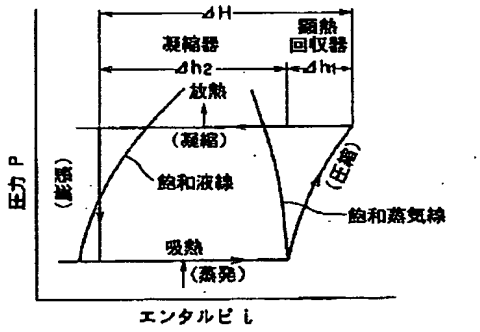
【図１】


2 顕熱回収器
11 バイパス配管
12 流量制御バイパス弁
20
3 凝縮器
21
10
M
1 圧縮機
4 受液器
9 制御盤
8 流量制御バイパス弁
5 膨張弁
7 バイパス配管
6 蒸発器
22

【図２】


2
20
3
21
10
1
M
4
7
8
9
5
6
22

【図３】


ΔH
凝縮器
顕熱回収器
Δh2
Δh1
放熱
(凝縮)
飽和液線
(圧縮)
飽和蒸気線
吸熱
(蒸発)
圧力 P
(膨張)
エンタルピ i

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